Claims

1. *(Currently amended)* A perpendicular magnetic recording disk comprising:

a substrate;

a layer of antiferromagnetic material on the substrate;

a laminated underlayer on the substrate, the underlayer comprising ~~a laminate of first and second ferromagnetic layers and a nonferromagnetic spacer layer between and in contact with the two ferromagnetic layers, the two ferromagnetic layers being exchange coupled antiferromagnetically across the spacer layer, whereby the magnetic moments of the two ferromagnetic layers are antiparallel~~ N ferromagnetic layers and N-1 nonferromagnetic spacer layers, wherein N is greater than 2, each of the spacer layers being located between and in contact with two adjacent ferromagnetic layers, a first of the N ferromagnetic layers being located on and in contact with the layer of antiferromagnetic material and having its magnetic moment pinned in a preferred direction by being exchange biased with said antiferromagnetic material, each of the spacer layers having a thickness sufficient to induce antiferromagnetic exchange coupling across said adjacent ferromagnetic layers, whereby the magnetic moments of adjacent ferromagnetic layers are oriented generally antiparallel in the absence of an applied magnetic field;

~~a layer of antiferromagnetic material between the first ferromagnetic layer and the substrate for pinning the magnetic moment of the first ferromagnetic layer in a preferred direction; and~~

a magnetic recording layer of material having perpendicular magnetic anisotropy on the laminated underlayer; and

wherein the ferromagnetic layers in the underlayer other than the ferromagnetic layer in contact with the layer of antiferromagnetic material and the ferromagnetic layer nearest the magnetic recording layer have substantially the same thickness t_{fm}, wherein the ferromagnetic layer nearest the magnetic recording layer has a thickness t_{top} and wherein $(t_{fm} - t_{top})/t_{fm}$ approximately equals 1/2.

2. *(Original)* The disk of claim 1 further comprising an exchange break layer between the underlayer and the magnetic recording layer for preventing magnetic exchange coupling between the ferromagnetic layers of the laminated underlayer and the magnetic recording layer.

3. *(Original)* The disk of claim 2 wherein the exchange break layer is formed of material consisting essentially of titanium.

4. *(Original)* The disk of claim 2 wherein the exchange break layer is formed of material selected from the group consisting of Si, Ge, SiGe alloys, Cr, Ru, W, Zr, Nb, Mo, V, Al, CrTi, NiP, CN_x, CH_x ,C, and oxides, nitrides and carbides of an element selected from the group consisting of Si, Al, Zr, Ti, and B.

5. *(Original)* The disk of claim 1 wherein the ferromagnetic layers of the underlayer are formed of an alloy comprising cobalt and iron.

6. *(Currently amended)* The disk of claim 5 wherein the cobalt-iron alloy includes an element selected from the group consisting of nickel, boron and copper.

7. *(Original)* The disk of claim 1 wherein the ferromagnetic layers of the underlayer are formed of a material selected from the group consisting of alloys of CoFe, CoNiFe, NiFe, FeCoB, CoCuFe, FeAlSi, FeTaN, FeN, FeTaC, CoTaZr and CoZrNb.

8. *(Currently amended)* The disk of claim 1 wherein the spacer ~~layer~~ layers of the underlayer ~~is~~ are formed of a material selected from the group consisting of ruthenium (Ru), chromium (Cr), rhodium (Rh), iridium (Ir), copper (Cu), and their alloys.

9. *(Currently amended)* The disk of claim 8 wherein the spacer ~~layer~~ layers of the laminated underlayer ~~is~~ are formed of Ru.

10. *Canceled*

11. *(Original)* The disk of claim 1 wherein the antiferromagnetic material is a material selected from the group consisting of FeMn, NiMn, PtMn, IrMn, PdPtMn and NiO.

12. *Canceled.*

13. *(Currently amended)* The disk of claim 1 wherein the magnetic moments of the ~~two~~ ferromagnetic layers in the underlayer are oriented generally radially on the disk.

14. *(Currently amended)* The disk of claim 1 wherein the magnetic moments of the ~~two~~ ferromagnetic layers in the underlayer are oriented generally circumferentially on the disk.

15. *(Currently amended)* A perpendicular magnetic recording disk having a generally circular shape and comprising:

a substrate;

a layer of antiferromagnetic material on the substrate;

a laminated underlayer on the substrate, the underlayer comprising N ferromagnetic layers and N-1 nonferromagnetic spacer layers, wherein N is greater than ~~or equal to~~ 2, each of the spacer layers being located between and in contact with two adjacent ferromagnetic layers, a first of the N ferromagnetic layers being located on and in contact with the layer of antiferromagnetic material and having its magnetic moment pinned in a generally radial direction by being exchange biased with said antiferromagnetic material, each of the spacer layers having a thickness sufficient to induce antiferromagnetic exchange coupling across said adjacent ferromagnetic layers, whereby the magnetic moments of adjacent ferromagnetic layers are oriented generally antiparallel in the absence of an applied magnetic field, said magnetic moments being aligned in a generally radial direction on the disk in the absence of an applied magnetic field;

a magnetic recording layer of material having perpendicular magnetic anisotropy on the laminated underlayer; and

wherein the ferromagnetic layers in the underlayer other than the ferromagnetic layer in contact with the layer of antiferromagnetic material and the ferromagnetic layer nearest the magnetic recording layer have substantially the same thickness t_{fm}, wherein the ferromagnetic layer nearest the magnetic recording layer has a thickness t_{top} and wherein $(t_{fm} - t_{top})/t_{fm}$ approximately equals 1/2.

16. *Canceled.*

17. *(Original)* The disk of claim 15 further comprising an exchange break layer between the laminated underlayer and the magnetic recording layer for preventing magnetic exchange coupling between the ferromagnetic layers of the laminated underlayer and the magnetic recording layer.

18. *(Original)* The disk of claim 17 wherein the exchange break layer is formed of material consisting essentially of titanium.

19. *(Original)* The disk of claim 17 wherein the exchange break layer is formed of material selected from the group consisting of Si, Ge, SiGe alloys, Cr, Ru, W, Zr, Nb, Mo, V, Al, CrTi, NiP, CN_x, CH_x ,C, and oxides, nitrides and carbides of an element selected from the group consisting of Si, Al, Zr, Ti, and B.

20. *(Original)* The disk of claim 15 wherein the ferromagnetic layers of the laminated underlayer are formed of an alloy comprising cobalt and iron.

21. *(Original)* The disk of claim 20 wherein the cobalt-iron alloy includes an element selected from the group consisting of nickel, boron and copper.

22. *(Original)* The disk of claim 15 wherein the ferromagnetic layers of the laminated underlayer are formed of a material selected from the group consisting of alloys of CoFe, CoNiFe, NiFe, FeCoB, CoCuFe, FeAlSi, FeTaN, FeN, FeTaC, CoTaZr and CoZrNb.

23. *(Original)* The disk of claim 15 wherein the spacer layers of the laminate underlayer are formed of a material selected from the group consisting of ruthenium (Ru), chromium (Cr), rhodium (Rh), iridium (Ir), copper (Cu), and their alloys.

24. *(Original)* The disk of claim 15 wherein the spacer layers of the laminated underlayer are Ru.

25. *Canceled.*

26. *(Currently amended)* The disk of claim 15 wherein the antiferromagnetic material is a material selected from the group consisting of FeMn, NiMn, PtMn, IrMn, PdPtMn and NiO.